

PATENT ABSTRACTS OF JAPAN

(11)Publication number : 2000-334951

(43)Date of publication of application : 05.12.2000

(51)Int.Cl.

B41J 2/05

(21)Application number : 11-145715

(71)Applicant : CASIO COMPUT CO LTD

(22)Date of filing : 26.05.1999

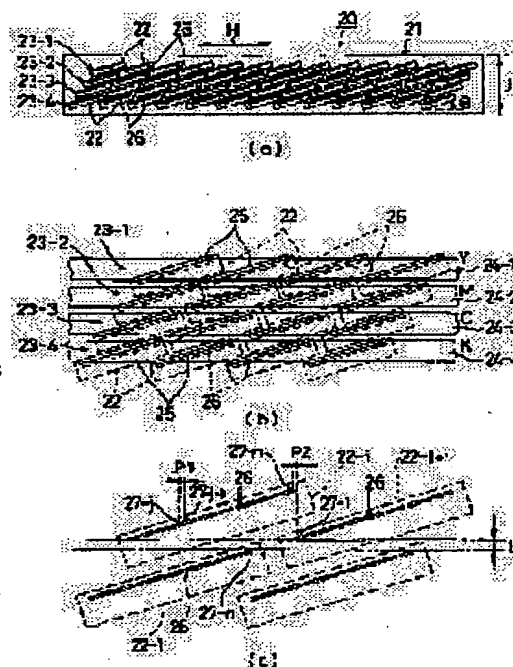
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(54) MULTI-ARRAY INK JET PRINT HEAD

(57)Abstract:

PROBLEM TO BE SOLVED: To provide a multi-array ink jet print head provided with a minimum number of ink supply passages and having a narrow width in the short side direction.

SOLUTION: Nozzle arrays 26 are arranged on the master substrate 21 of a print head 20 while inclining at an angle θ wherein thirteen print chips 22 in an array constitute a subhead 23 (23-1, 23-2, 23-3 or 23-4). Vertically or laterally adjacent print chips 22 are interlaces obliquely between subheads 23 and no useless gap is present. The print head 20 has width J in the short side direction which is narrower than that of a conventional multi-array print head. Each subhead 23 corresponds to one ink supply passage 24 (24-1, 24-2, 24-3 or 24-4) and total four ink supply passages 24 communicate, respectively, with four ink storage chambers of yellow Y, magenta M, cyan C and black K of one ink tank.



LEGAL STATUS

[Date of request for examination]

18.09.2003

[Date of sending the examiner's decision of rejection]

[Kind of final disposal of application other than the examiner's decision of rejection or application converted registration]

[Date of final disposal for application]

[Patent number]

[Date of registration]

[Number of appeal against examiner's decision of rejection]

[Date of requesting appeal against examiner's decision of rejection]

[Date of extinction of right]

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CLAIMS

[Claim(s)]

[Claim 1] The subhead which arranges two or more printing chips which have arranged two or more ink regurgitation nozzles in the shape of a straight line with the predetermined include angle θ (however, $\theta \neq 0$) to the predetermined direction, and changes, and the multi-array type ink jet print head which arranges two or more these subheads in the direction of a right angle to said predetermined direction, and changes.

[Claim 2] Said predetermined direction is a multi-array type ink jet print head according to claim 1 characterized by being the main scanning direction of printing.

[Claim 3] Said predetermined direction is a multi-array type ink jet print head according to claim 1 characterized by being the direction of vertical scanning of printing.

[Claim 4] Said predetermined include angle θ is a multi-array type ink jet print head according to claim 1 characterized by being 5 times or more and 45 degrees or less.

[Claim 5] Said two or more printing chips arranged at said one subhead are multi-array type ink jet print heads according to claim 1, 2, 3, or 4 characterized by sharing dedication and a single ink supply way.

[Claim 6] Said ink regurgitation nozzle is a multi-array type ink jet print head according to claim 1, 2, 3, 4, or 5 characterized by consisting of the 2nd train which only the predetermined distance a shifted to the longitudinal direction of the 1st train and this 1st train within said printing chip, and only the predetermined distance b left in the direction of a short hand of said 1st train.

[Claim 7] The distance f of a direction right-angled in said predetermined direction between the ink regurgitation nozzle of the toe of said 1st train in said printing chip, and the ink regurgitation nozzle of the toe of said 2nd train The distance g of a right-angled direction in said predetermined direction between the ink regurgitation nozzles of the heel of said 1st train of the printing chip which adjoins in said predetermined direction of the ink regurgitation nozzle of the heel of said 2nd train, and this printing chip The multi-array type ink jet print head according to claim 6 characterized by being the same distance " $f=g$."

[Claim 8] said ink regurgitation nozzle -- the inside of said printing chip -- the 1st vertical 4 train -- this -- the multi-array type ink jet print head according to claim 1 characterized by consisting of the 2nd vertical 4 train which only the predetermined distance j shifted to the longitudinal direction of the 1st vertical 4 train, and only the predetermined distance k left in the direction of a short hand of said 1st vertical 4 train.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention relates to the multi-array type ink jet print head to which the ink supply way formed in the longitudinal direction of a parent substrate changes only from one for every color.

[0002]

[Description of the Prior Art] There is an ink jet printer which prints by breathing out the ink of an ink bottle to a form side conventionally. An ink jet printer records the alphabetic character and image according to printing information by the print head equipped with the printing component of a large number formed in 300dpi (dots per inch) or the detailed resolution beyond it (printing, printing).

[0003] The record approach by the ink jet printer A chip-like small substrate The ink regurgitation side of (calling it a printing chip hereafter) is made to breathe out the drop of ink from the detailed nozzle arranged. [many] In this ink droplet (printing dot), make it reach the target, it is made to absorb, this records an alphabetic character, an image, etc., recorded materials, such as paper and cloth, have [the regurgitation and] little generating of the noise, and full color record is also the comparatively easy record approach, without requiring special fixing processing.

[0004] Full color record is performed using the ink of four colors which added the black usually used for an alphabetic character, the black part of an image, etc., using the ink of three colors of the yellow (yellow) which is subtractive primary colors, a Magenta (red color name), and cyanogen (blue with greenishness).

[0005] An ink chamber is made to produce the pressure by the mechanical deformation, using electric machine sensing elements, such as a PIEZO resistance element (piezoelectric device), as an approach of making the drop of ink breathing out. A heater element is allotted to the piezo jet method which makes a drop breathe out from a minute nozzle by this, and a detailed ink room. Give this an electric pulse, the interface of ink and a heater element is made to generate air bubbles at high speed, and there is a thermal jet method which makes a drop breathe out from a minute nozzle similarly using the growth force of the air bubbles.

[0006] Moreover, the above-mentioned thermal jet method has two kinds of configurations with the discharge direction of an ink droplet. One is the side shooter mold of a configuration of carrying out the regurgitation of the ink in the direction parallel to the exoergic side of a heater element, and other one is a roof shooter mold which carries out the regurgitation of the ink in the direction perpendicular to the

exoergic side of a heater element.

[0007] There is the approach of forming at a monolithic the drive circuit and ink supply way which drive two or more heater elements and these separately using a silicon LSI formation processing technique and thin film coating technology as a process of the printing chip used for the thermal ink jet printer of such a roof shooter mold, and an ink regurgitation nozzle on one silicon chip substrate.

[0008] According to this approach, when resolution creates the printing chip of 360dpi (dots per inch), for example on a 10mmx15mm silicon chip substrate, 128 heater elements, drive circuits, and ink regurgitation nozzles can be formed.

[0009] Drawing 6 (a) It is the top view showing the ink regurgitation side of such a printing chip, and is this drawing (b). It is the rear view. Moreover, this drawing (c) This drawing (a) It is the enlarged drawing in which removing the orifice plate of the part squarely surrounded with the alternate long and short dash line a, and showing the interior, and is this drawing (d). This drawing (c) It is an A-A' cross-section view Fig.

[0010] This drawing (a) The shown printing chip 1 is 4 train preparation ***** about the nozzle train 2 on one silicon chip substrate 3. The nozzle train 2 of these 4 train is constituted so that the regurgitation of yellow ink (Y), Magenta ink (M), cyanogen ink (C), or the black (K) ink may be carried out, respectively.

[0011] This drawing (a) - (d) The drive circuit 4 was formed in the top face of the silicon chip substrate 3 by the LSI formation processing technique, it was punctured by wet etching and, as for the printing chip 1, the ink receipt hole 6 which opens for free passage into this ink supply slot 5, and carries out opening to the rear face of the silicon chip substrate 3 has penetrated [the ink supply slot 5] the silicon chip substrate 3 so that it may be shown.

[0012] Between the above-mentioned drive circuit 4 and the ink supply slot 5, by the thin film coating technology by a photolithography technique etc. A large number formation of the heater element 7 is carried out for 64 pieces, 128 pieces, or 256 etc. pieces. Furthermore, common electrode 8a and individual wiring electrode 8b are connected to these heater elements 7 as a wiring electrode 8, the electrode terminal 4-1 of the drive circuit 4 is connected to the individual wiring electrode 8b, and the electrode terminal 10 for connection with the exterior is formed in the edge 9 of the upper and lower sides of silicon chip substrate 3 front face, respectively.

[0013] And on these, the laminating of the septum 11 is carried out all over removing the electrode terminal 10 above-mentioned part for connection. The septum 11 formed the ink seal wall which intercepts ink from the outside to the left of the ink supply slot 5 by one side, the ink seal wall which similarly intercepts ink from the outside on individual wiring electrode 8b and the drive circuit 4 on the other hand was formed, and the septum 11 of this individual wiring electrode 8b part is further equipped with the protrusion section 11-1 which begins to be extended between each heater element 7 and a heater element 7. The configuration in which the protrusion section 11-1 which will begin to be extended between each heater element 7 the drum of a comb, then from now on is equivalent to the gear tooth of a comb in the part on above-mentioned individual wiring electrode 8b of a septum 11 and the drive circuit 4 is made. Thereby, the detailed ink pressurized room 12 where a heater element 7 is located in the root part between that gear tooth and gear tooth is divided and formed only for the number of heater elements 7 by using the gear tooth of this comb as a bridgewall.

[0014] Furthermore, the laminating of the orifice plate 13 is carried out to the maximum upper layer of the silicon chip substrate 3 with which these drive circuits 4, a heater element 7, common electrode 8a,

individual wiring electrode 8b, and a septum 11 were formed, many ink regurgitation nozzles 14 are drilled in the location which counters the above-mentioned heater element 7 of the orifice plate 13, and the nozzle train 2 of four trains mentioned above is formed. The nozzle train 2 of four trains is mutually parallel, and is formed, and the ink regurgitation nozzle 14 of an edge keeps step with the same height, and is formed mutually. That is, the nozzle train 2 of four trains is formed so that there may be no gap of the upper and lower sides mutually.

[0015] In now, the resolution of such a printing chip 1, i.e., the arrangement pitch of the ink regurgitation nozzle 14, is very common, and its 600dpi is common in the thing of 300dpi (dots per inch) and high resolution. When 600dpi is seen by milli conversion, the printing component which consists of about 24 the heater elements 7 and the ink regurgitation nozzles 14 per mm will be located in a line with a single tier, and the pitch is about 42 micrometers.

[0016] In such a configuration, the printing chip 1 is completed on the silicon chip substrate 3 of a large number on a non-illustrated silicon wafer. And finally, a dicing saw etc. and it divides according to an individual for every chip substrate unit, and dice bonding is carried out to a mounting substrate, terminal strapping is carried out to it, and it becomes the printing chip of a practical unit. [use and]

[0017] The ink supplied to the ink receipt hole 6 from the exterior is supplied to the ink pressurized room 12 through the ink supply slot 5, a heater element 7 energizes this printing chip 1 alternatively according to printing information on the occasion of printing, generate heat in an instant, ink is made to generate a film-boiling phenomenon, and an ink droplet is breathed out by the pressure of those nucleus air bubbles from the ink regurgitation nozzle 14 corresponding to a heater element 7.

[0018] Generally, a printer can be classified into a serial type and a Rhine style as a classification on a configuration. By the serial formula, although the above-mentioned printing chip 1 was conventionally used alone as the print head in many cases, by recent years, the print head which has arranged two or more printing chips 1 in the direction of vertical scanning of printing, and long-picture-ized them in it is being put in practical use. The reason for arranging two or more small printing chips 1, and long-picture-izing them is that it cannot make the printing chip of a simple substance from a long picture since various limitations are in the processing technique (mainly processing equipment) of the printing chip 1.

[0019] The printing speed of a printer is influenced by whether to have many printing chips 1 arranged or an above-mentioned serial-type printer is few. Of course, since the width of face (dip) of the direction of vertical scanning which the way with many printing chips 1 arranged to the longitudinal direction of a nozzle train prints by horizontal scanning once spreads, printing processing serves as a high speed. On the other hand, a Rhine style printer is a method which fixes the print head to the body side of a printer using the print head which arranged and long-picture-ized the printing chip 1 to the limit of the printing area of a main scanning direction, and conveys only a form, the method itself supports rapidity and a mechanical load is [it is small, there is little power consumption, and] also economical [the printer].

[0020] therefore, like recent years, in order to meet the request of wanting to make it a high speed more, the rate of printing processing In the case of a serial-type printer, in order to perform long printing of a dip as much as possible by printing of horizontal scanning of one line It is an indispensable activity from the start for it to be necessary to inherit two or more printing chips in the direction of vertical scanning, and to form a long print head in the direction of vertical scanning and, to inherit two or more printing chips to a main scanning direction, when it is a Rhine style printer, and to form a print head.

[0021] But by the serial-type printer, if the number of the printing chips 1 is made [many] not much, the load at the time of a print head moving will become large, and troublesome various problems, such as degradation of a quality of printed character, strengthening of a frame, and enlargement of equipment, will occur. Therefore, a Rhine style printer benefits improvement in the speed the lead in future development.

[0022] Drawing 7 is drawing showing typically the configuration of the color print head of such a Rhine style printer. As shown in this drawing, the color print head 15 extends in the main scanning direction shown by the both-directions arrow head x of drawing, and they are a total of 12 drawing 6 (a). On the parent substrate 16, the shown printing chip 1 is alternately arranged in the shape of an alternate pattern (staggered arrangement), and forms the printing area of die-length B in the main scanning direction.

[0023] Thus, shifting the printing chip 1 alternately and arranging by staggered arrangement Even if it is because there is a edge 9 (refer to drawing 6 (a)) and carries out adhesion arrangement of the printing chip 1 at the shape of a straight line It is because the ink regurgitation nozzle 14 of each edge of the nozzle train 2 of the adjoining printing chip 1 and the nozzle train 2 will separate distance, and will exist only the twice of a edge 9, so the nozzle train 2 of each printing chip 1 does not continue at intervals of the right.

[0024] Drawing 8 (a) It is drawing showing the configuration of the ink supply way by the side of the parent substrate which supplies ink to the printing chip 1 arranged as mentioned above at the parent substrate 16, and is this drawing (b). This drawing (a) It is a C-C' cross-section expansion view Fig. Moreover, this drawing (c) The printing chip 1 is re-**(ed), and is shown and it is this drawing (d). It is the D-D' cross-section expansion view Fig. This drawing (a) The parent substrate 16 before arranging the printing chip 1 is shown, and broken-line 1' shows the location which should arrange the printing chip 1.

[0025] This drawing (a) The ink tank 17 (17-1, 17-2) is arranged in the both ends of the printing area in which the printing chip 1 is arranged by the parent substrate 16 so that it may be shown. And each ink tank 17 is equipped with the ink reservoir of four rooms which contains the ink of yellow (Y), a Magenta (M), cyanogen (C), and black (K), and eight ink supply ways 18 which are open for free passage to these are formed on the parent substrate 16. Among eight ink supply ways 18, four ink supply ways 18 are open for free passage to each ink reservoir of one ink tank 17-1, respectively, and are opening other four ink supply ways 18 for free passage, respectively to each ink reservoir of the ink tank 17-2 of another side.

[0026] and drawing 8 (a) six printing chips 1 located in a line with width 1 train up so that it may be shown -- (drawing 7 -- reference) -- respectively -- drawing 8 (d) And this drawing (b) As the broken-line arrow head E of a between shows It is arranged on four ink supply ways 18 which begin to be extended from one ink tank 17-1, and the ink receipt hole 6 of printing chip 1 rear face and the ink supply way 18 of the parent substrate 16 are open for free passage through the connection hole formed in the non-illustrated adhesion sealing material. Moreover, it is arranged on four ink supply ways 18 where six printing chips 1 similarly caudad located in a line with width 1 train begin to be extended from the ink tank 17-2 of another side, and the ink receipt hole 6 of printing chip 1 rear face and the ink supply way 18 of the parent substrate 16 are open for free passage through the connection hole similarly formed in the non-illustrated adhesion sealing material.

[0027] Thereby, it is this drawing (c). The yellow of the shown printing chip 1, a Magenta, the ink supply slot 5 (drawing 6 (c) --) shown in this drawing (c) currently formed in parallel with the nozzle train of four

trains corresponding to cyanogen and black regurgitation ink with a two-dot chain line in fluoroscopy (d) The ink of the color corresponding to reference is supplied from the ink tank 17-1 or 17-2 through the ink supply way 18 and the ink receipt hole 6, respectively.

[0028] Drawing 9 is drawing expanding and showing the relation of the arrangement location of the ink supply way 18 of the above-mentioned parent substrate 16, and the ink receipt hole 6 of the printing chip 1. This drawing shows the printing chip 1 and nozzle train 14' with the broken line in order to show only an important section intelligibly. ***** by which three ink receipt holes 6 of each printing chip 1 which correspond for every train of nozzle train 14' of four trains, respectively are arranged on the ink supply way 18 of the color ink corresponding to these as shown in this drawing.

[0029]

[Problem(s) to be Solved by the Invention] However, the useless big tooth space G is made with the configuration of the color print head 15 mentioned above, i.e., arrangement of the printing chip 1 which carried out staggered arrangement to the parent substrate 16, between each printing chip 1 located in a line with one train in a main scanning direction (longitudinal direction of drawing 9), and the printing chip 1. And in order to bury this printing null section, it is the arrangement which shifted the adjoining printing chip 1 to a top or the bottom, and carried out staggered arrangement of the printing chip 1 of two trains to the main scanning direction as a whole. Consequently, it has the first fault that the width of face of the direction of vertical scanning of the color print head 15 will become large. Moreover, as shown in this drawing, no less than eight ink supply ways 18 were required, and now, it assembled and had the 2nd fault the trouble at the time and the time of maintenance not only starts, but that two ink tanks 17 were also needed and cost increased.

[0030] The technical problem of this invention is having minimum number of ink supply ways, and there being no useless tooth space in view of the above-mentioned conventional actual condition, and offering a multi-array type ink jet print head with the narrower width of face of the direction of a short hand.

[0031]

[Means for Solving the Problem] The multi-array type ink jet print head of this invention arranges two or more subheads which arrange two or more printing chips which have arranged two or more ink regurgitation nozzles in the shape of a straight line with the predetermined include angle θ (however, $\theta \neq 0$) to the predetermined direction, and change, and these subheads in the direction of a right angle to the above-mentioned predetermined direction, and is constituted.

[0032] Like for example, claim 2 publication, the above-mentioned predetermined direction is a main scanning direction of printing, and like for example, claim 3 publication, it is constituted so that it may become the direction of vertical scanning of printing. Moreover, the thing [that they are 5 times or more and 45 degrees or less] according to claim 4 of the above-mentioned predetermined include angle θ is [like] desirable, for example.

[0033] Moreover, two or more above-mentioned printing chips arranged at the one above-mentioned subhead share dedication and a single ink supply way like for example, claim 5 publication, and are constituted. Moreover, the above-mentioned ink regurgitation nozzle consists of the 2nd train according to claim 6 which only the predetermined distance a shifted to the longitudinal direction of the 1st train and this 1st train within the above-mentioned printing chip, and only the predetermined distance b left in the direction of a short hand of the 1st train of the above like, for example.

[0034] and -- for example, -- being according to claim 7 -- with the distance f of a right-angled direction

like in the above-mentioned predetermined direction between the ink regurgitation nozzle of the toe of the 1st train of the above in the above-mentioned printing chip, and the ink regurgitation nozzle of the toe of the 2nd train of the above As for the distance g of a direction right-angled in the above-mentioned predetermined direction between the ink regurgitation nozzles of the heel of the 1st train of the above of the printing chip which adjoins in the above-mentioned predetermined direction of the ink regurgitation nozzle of the heel of the 2nd train of the above, and this printing chip, it is desirable to constitute so that it may become the same distance " $f=g$."

[0035] moreover, the above-mentioned ink regurgitation nozzle -- for example, -- being according to claim 8 -- like -- the inside of the above-mentioned printing chip -- the 1st vertical 4 train -- this -- you may make it constitute from the 2nd vertical 4 train which only the predetermined distance j shifted to the longitudinal direction of the 1st vertical 4 train, and only the predetermined distance k left in the direction of a short hand of vertical 4 train of the above 1st

[0036]

[Embodiment of the Invention] Hereafter, the gestalt of operation of this invention is explained, referring to a drawing. Drawing 1 (a) It is the printing chip plot plan of the multi-array type ink jet print head in the gestalt of the 1st operation, and is this drawing (b). The enlarged drawing and this drawing (c) It is drawing expanding and showing the part further.

[0037] This drawing (a) The shown print head 20 is an ink jet print head for full color of a multi-array type, and much printing chips 22 lean to the parent substrate 21, and are arranged. In addition, this drawing (a) In the shown example, the printing chip 22 is a printing chip with which the nozzle train 26 consists only of one train. Moreover, although a total of 52 printing chips 22 is arranged to the parent substrate 21, the number of arrangement of the printing chip 22 is not necessarily restricted with 52 pieces, and is good by the number of arbitration according to the plan of a design.

[0038] This drawing (a) In the shown print head 20 The direction where one subhead 23 (23-1, 23-2, 23-3, or 23-4) constituted with 13 printing chips 22 which inclined to the main scanning direction shown by the both-directions arrow head H aslant, and have been arranged is as right-angled as the above-mentioned main scanning direction, That is, it is arranged together with [plurality (at the example shown in this drawing (a), it is four)] the direction of vertical scanning.

[0039] Since each printing chip 22 inclines aslant and these subheads 23 are complex, four subheads 23-1 to 23-4 are not necessarily formed independently, become intricate mutually partially, are formed, and constitute the print head 20 as a whole. theta is 5 times or more and 45 degrees or less to a main scanning direction whenever [angle-of-inclination / of each above-mentioned printing chip 22].

[0040] Thus, since it inclines aslant, and each printing chip 22 of four subheads 23 becomes intricate and is arranged, there is no useless big that is, gap between each printing chip 22 which adjoins vertically and horizontally, and the width of face J of the direction of vertical scanning of a print head 20 is narrower than the width of face F of the direction of vertical scanning of the conventional color print head 15 which only the part showed to drawing 7 (refer to drawing 9).

[0041] And in this parent substrate 21, it is this drawing (b). So that it may be shown Yellow of one non-illustrated ink tank, Four ink supply ways 24 (24-1, 24-2, 24-3, 24-4) which are open for free passage, respectively are formed in Macenta, cyanogen, and four black ink reservoir rooms. In the adhesion sealing material infixed between the printing chips 22 arranged on these ink supply way 24 The long and slender ink free passage hole 25 corresponding to two or more ink receipt holes (formed like three ink receipt

holes 6 for every nozzle train shown in drawing 8 (c), (d), and drawing 9) of the ink supply way 24 and each printing chip 22 is formed.

[0042] Thus, each subhead 23 consists of one ink supply way 24 corresponding to the ink of one color, and 13 printing chips 22 which leaned aslant and were arranged on this, respectively, and the ink supply way 24 consists of only four as the print head 20 whole.

[0043] To a main scanning direction, two or more (this example 13) every above-mentioned subhead 23 by this a certain printing chip 22 It is constituted so that dedication and the single ink supply way 24 (24-1, 24-2, 24-3, or 24-4) may be shared. Each printing chip 22 of the subhead 23-1 For example, yellow (Y) ink, Cyanogen (C) ink and each printing chip 22 of the subhead 23-4 are [each printing chip 22 of the subhead 23-2] equivalent to black (K) ink for each printing chip 22 of Magenta (M) ink and the subhead 23-3.

[0044] Moreover, it sets to arrangement of the printing chip 22 which inclined aslant [above-mentioned], and is this drawing (c). So that it may be shown printing chip 22-i ($i = 1, 2, \text{and } \dots$) which adjoins within the same subhead The pitch P2 of the main scanning direction between 13), ink regurgitation nozzle 27-n (n : the number of ink regurgitation nozzle configurations within the nozzle train 26) of the edge where each nozzle train 26 and 26 of 22-i+1 approaches mutually, and 27-1 It is the same as that of the pitch P1 between ink regurgitation nozzle 27j within the nozzle train 26 ($j = 1, 2, \dots, n$).

[0045] Moreover, while adjoins between the adjoining subheads and the gap L of the direction of vertical scanning between printing chip 22-i of a subhead, ink regurgitation NOZUSU 27-n of the edge where each nozzle train 26 and 26 of the printing chip 22-i+1 of the subhead of another side approaches mutually, and 27-1 supports the distance between the ink of a different color breathed out by the ink regurgitation nozzle 27. as for this distance (gap L), it be desirable to be referred to as 0.5mm or more, and it be elaborate -- be alike -- in case wiping of the ink regurgitation nozzle 27 (that is, nozzle train 26) is carried out to a main scanning direction with the wiper which is not illustrated [Li and], the color mixture of ink can be prevented.

[0046] Drawing 2 is drawing showing the modification in the gestalt of implementation of the above 1st. The print head 30 shown in this drawing leans long 4 color chip 32 to the parent substrate 31 aslant a little, and are arranged. [two or more (the example of this drawing ten pieces)] The nozzle train 33 turns into one train, and is arranged in the longitudinal direction by four trains of four color each chips 32. The nozzle train 33 of these 4 train carries out the regurgitation of yellow (Y) ink, Magenta (M) ink, cyanogen (C) ink, and the black (K) ink, respectively. Moreover, although not illustrated especially, four ink supply ways which supply the ink of the color corresponding to these nozzle trains 33 are formed on the parent substrate 31.

[0047] if only the configuration of the nozzle train 33 of the interior divided with the broken line 28 and broken line 29 which are shown in this drawing is seen -- these nozzle train arrangement configurations -- drawing 1 (a) and (b) It turns out that it is the same as that of the shown nozzle train arrangement configuration of the print head 20 in the gestalt of the 1st operation. Thus, even if constituted, the number of the printing chips which the same effectiveness as the print head 20 of drawing 1 is acquired, and are carried in the parent substrate 31 can be reduced about to 1/4 by simple count as compared with the print head 20 of drawing 1 .

[0048] Drawing 3 (a) It is the top view of the outline of the printing chip concerning the gestalt of the 2nd operation, and is this drawing (b). Drawing and this drawing (c) showing the print head which arranged the printing chip Drawing and this drawing (d) showing the ink supply way of the parent substrate,

arrangement of an adhesion sealing material's free passage hole, and a configuration are this drawing (b). It is an enlarged drawing a part.

[0049] This drawing (a) This printing chip 35 is equipped with the nozzle train 36 (36-1, 36-2) of two trains which consist of many ink regurgitation nozzles 34 so that it may be shown. These nozzle train 36 consists of nozzle trains 36-2 as the 2nd train which only the predetermined distance a shifted to the longitudinal direction of the nozzle train 36-1 as the 1st train, and this nozzle train 36-1, and only the predetermined distance b left in the direction of a short hand of the nozzle train 36-1.

[0050] It is arranged by the parent substrate 37 after such a printing chip 35 has inclined to the main scanning direction shown by the both directions arrow head M of drawing also in this case aslant. And one subhead 38 (38-1, 38-2, 38-3, or 38-4) formed with two or more printing chips 35 on a par with the main scanning direction constitutes the print head 40 from 4 ***** in the direction of vertical scanning. Also in this case, delta is 5 times or more and 45 degrees or less to a main scanning direction whenever [angle-of-inclination / of the printing chip 35].

[0051] Since the printing chip 35 of each subhead 38 inclines aslant and is complex also in this case, there is no big gap between each printing chip 35 which adjoins vertically and horizontally, and the width of face N of the direction of vertical scanning of a print head 40 is narrower than the width of face F of the direction of vertical scanning of the conventional color print head 15 which only that part showed to drawing 7 (refer to drawing 9).

[0052] and -- this parent substrate 37 -- this drawing (c) it is shown -- as -- the yellow (Y) of one non-illustrated ink tank, and Macenta -- four ink supply ways 41 (41-1, 41-2, 41-3, 41-4) which are open for free passage, respectively are formed in (M), cyanogen (C), and four black (K) ink reservoir rooms.

[0053] In the adhesion sealing material infixed between the printing chips 35 arranged on these ink supply way 41 The ink receipt hole of the nozzle train 36-2 of long and slender a little short ink free passage hole 42a and printing chip 35-k (the number of printing chips arranged by k:1 subhead 38) of the other-end section corresponding to the ink receipt hole of the nozzle train 36-1 of the printing chip 35-1 of one edge in the both ends of the ink supply way 41 It is alike and long and slender a little short corresponding ink free passage hole 42b is formed. In middle parts other than both ends The ink free passage hole 43 extended long and slender with the level difference shared with the nozzle train 36-1 of printing chip 35-q (2 q= three ..., k) and the nozzle train 36-2 of the printing chip 35-q-1 is formed.

[0054] Thus, each subhead 38 consists of one ink supply way 41 corresponding to the ink of one color, and k printing chips 35 which leaned aslant and were arranged on this, respectively, and consists of four ink supply ways 41-1 to 41-4 also in this case as the print head 40 whole.

[0055] To a main scanning direction, two or more (k pieces) every above-mentioned subhead 38 and a certain printing chip 35 It is constituted so that dedication and the single ink supply way 41 may be shared, for example, it is this drawing (c). So that it may be shown Each printing chip 35 of the subhead 38-1 each printing chip 35 of yellow (Y) ink and the subhead 38-2 Magenta (M) ink, Cyanogen (C) ink and each printing chip 35 of the subhead 38-4 are equivalent to black (K) ink for each printing chip 35 of the subhead 38-3.

[0056] Thus, even if constituted, it is this drawing 3 (b). Above-mentioned drawing 1 (a) It compares, and arrangement of each nozzle train in a parent substrate is the same so that it may understand. Moreover, it sets to arrangement of the printing chip 35 which inclined aslant [above-mentioned], and is this drawing (d). So that it may be shown Each nozzle train 36-2 of the printing chips 35 and 35 which adjoin

within the same subhead, and 36-1, The pitch d3 of the main scanning direction between ink regurgitation nozzle 34-m (m: the number of ink regurgitation nozzle configurations within the nozzle train 36) of the edge which approaches mutually, and 34-1, the same nozzle train 36 (as an example) This drawing (d) The pitch d2 of the main scanning direction between the ink regurgitation nozzles 34-1 of the toe of ink regurgitation nozzle 34-m of the toe of the pitch d1 between ink regurgitation nozzle 34 within the nozzle train 36-1, and the nozzle train 36-1 in the same printing chip 35, and the nozzle train 36-2 It is constituted so that it may become the same [all].

[0057] Moreover, the ink regurgitation nozzle 34-1 of the heel of the nozzle train 36-1 of each printing chip 35 located in a line in the same subhead and the ink regurgitation nozzle 34-1 of the toe of the nozzle train 36-2 make a straight line to a main scanning direction, and are arranged in it. Similarly, ink regurgitation nozzle 34-m of the toe of the nozzle train 36-1 of each printing chip 35 and ink regurgitation nozzle 34-m of the heel of the nozzle train 36-2 also make a straight line to a main scanning direction, and are arranged in it.

[0058] Also in which subhead 38, it is desirable to set distance e of the nozzle train 36-1 of the printing chip 35, the nozzle train 36-1 of the printing chip 35 of the ink regurgitation nozzle 34-1 of each edge of 36-2 and the adjoining subhead 38, and the direction of vertical scanning with ink regurgitation nozzle 34-m of each edge of 36-2 to 0.5mm or more. This distance e is equivalent to the distance between the ink in which the colors of the ink breathed out by the nozzle train 36-1 of each subhead 38 and 36-2 differ, and by setting this distance e to 0.5mm or more, in case wiping of the subhead is carried out to a main scanning direction with a non-illustrated wiper, the color mixture of ink can be prevented.

[0059] Drawing 4 (a) Desirable arrangement is shown in inclination arrangement of the printing chip 35 in the same above-mentioned subhead, and it is this drawing (b). Although you may arrange in this way, the arrangement which cannot be said to be desirable is shown. Namely, this drawing (a) The shown printing chip arrangement The distance f of the direction of vertical scanning between the ink regurgitation nozzles 34-1 of the heel of the nozzle train 36-1 of the printing chip 35-q+1 of ink regurgitation nozzle 34-m of the heel of the nozzle train 36-2 of printing chip 35-q, and contiguity It is arranged so that it may become the same distance "f=g" as the distance g of the direction of vertical scanning between the ink regurgitation nozzles 34-1 of the toe of ink regurgitation nozzle 34-m of the toe of the nozzle train 36-1 of the same printing chip 35 (for example, printing chip 35-q+1 of this drawing (a)), and the nozzle train 36-2. Thus, if it arranges, since all the physical relationship of the direction of vertical scanning of nozzle **** in the same subhead which consists of a nozzle train 36-1 of each printing chip 35 and 36-2 will become the same, the circuit of a printing control section or the configuration of a program can be simplified more.

[0060] On the other hand, this drawing (b) It becomes [control of the regurgitation timing for every nozzle train] complicated that it is the arrangement from which distance f' between the nozzle trains in the same printing chip and distance g' between the nozzle trains of a contiguity printing chip differ and is troublesome so that it may be shown.

[0061] Drawing 5 (a) and (b) It is drawing showing the modification in the gestalt of implementation of the above 2nd. This drawing (a) The shown print head 45 leans long 4 color printing chip 47 to the parent substrate 46 aslant, and are arranged. [two or more (the example of this drawing ten pieces)]

[0062] This drawing (b) So that it may be shown 4 color printing chip 47 Nozzle train 49-1a of four trains in which the ink regurgitation nozzle 48 forms the 1st vertical 4 train within 4 color printing chip 47,

49-1b, 49-1c, and 49 to 1 d, Nozzle train 49-2a of four trains which are the 2nd vertical 4 train which only the predetermined distance j shifted to the longitudinal direction of the 1st vertical 4 train, and only the predetermined distance k left in the direction of a short hand of the 1st vertical 4 train, 49-2b, 49-2c, and 49 to 2 d are formed.

[0063] Also in this case, it is this drawing (a). It is drawing 3 (b) so that it may turn out that only arrangement of the 49 to 1 d nozzle train of the interior divided with the broken line 51 and broken line 52 which are shown, 49 to 2 d, etc. is seen. Or drawing 1 (a) Arrangement of the shown configuration and each nozzle train in the parent substrate 46 is the same. That is, also of this, the width of face of the direction of vertical scanning is narrow, and four print heads 45 are formed for an ink supply way.

[0064] In addition, although the gestalt of operation mentioned above explains as a print head for line printers which all makes the longitudinal direction of a print head the main scanning direction of printing, it is needless to say [the print head of this invention] that it is applicable to the print head for serial printers by making the longitudinal direction of a print head into the direction of vertical scanning, without restricting to this.

[0065]

[Effect of the Invention] Since according to this invention the printing chip which has the nozzle train of at least 1 train is leaned the degree of predetermined angle and more than one are arranged in a parent substrate as explained to the detail above The useless tooth space during a printing chip can be lessened as much as possible. By this While it becomes good with the configuration of the ink supply way of only the color number of ink while being able to make width of face of the direction of a short hand of a print head smaller than before, therefore being able to miniaturize the body of a printer more It becomes possible for the trouble at the time of an assembly and maintenance not to start, but to offer a low cost multi-array type ink jet print head.

[Translation done.]

*** NOTICES ***

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1. This document has been translated by computer. So the translation may not reflect the original precisely.

2. **** shows the word which can not be translated.

3. In the drawings, any words are not translated.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1] (a) The printing chip plot plan of the multi-array type ink jet print head in the operation gestalt of **** 1, and (b) The enlarged drawing and (c) It is drawing expanding and showing a part [further].

[Drawing 2] It is drawing showing the modification in the gestalt of the 1st operation.

[Drawing 3] (a) The top view of the outline of the printing chip concerning the operation gestalt of **** 2, and (b) Drawing and (c) which show the print head which arranged the printing chip Drawing and (d) which show the ink supply way of the parent substrate, arrangement of an adhesion sealing material's free passage hole, and a configuration (b) It is an enlarged drawing a part.

[Drawing 4] (a) Drawing and (b) which show the desirable inclination arrangement in the same subhead of the printing chip concerning the operation gestalt of **** 2 It is drawing showing the arrangement which cannot be said to be not much desirable.

[Drawing 5] (a) and (b) It is drawing showing the modification in the 2nd operation gestalt.

[Drawing 6] (a) The top view and (b) which show the ink regurgitation side of the printing chip of ***** The rear view and (c) (a) The enlarged drawing and (d) which show the interior of the part enclosed with an alternate long and short dash line a (c) It is an A-A' cross-section view Fig.

[Drawing 7] It is drawing showing typically the configuration of the color print head of the conventional Rhine style printer.

[Drawing 8] (a) Drawing and (b) which show the configuration of the ink supply way which supplies ink to the printing chip arranged at the parent substrate of the color print head of ***** (a) A C-C' cross-section expansion view Fig. and (c) Drawing and (d) which show a printing chip It is the D-D' cross-section expansion view Fig.

[Drawing 9] It is drawing expanding and showing the relation of the arrangement location of the ink supply way of the parent substrate of the conventional color print head, and the ink receipt hole of a printing chip.

[Description of Notations]

1 Printing Chip

2 Nozzle Train

3 Silicon Chip Substrate

4 Drive Circuit

4-1 Electrode Terminal

5 Ink Supply Slot
6 Ink Receipt Hole
7 Heater Element
8 Wiring Electrode
8a Common electrode
8b Individual wiring electrode
9 Edge
10 Electrode Terminal for Connection
11 Septum
11-1 Protrusion Section
12 Ink Pressurized Room
13 Orifice Plate
14 Ink Regurgitation Nozzle
14' Nozzle train
15 Color Print Head
16 Parent Substrate
17 (17-1, 17-2) Ink tank
18 Ink Supply Way
20 Print Head
21 Parent Substrate
22 and 22-i (i= 1, 2, ..., 13) Printing chip
23 (23-1, 23-2, 23-3, 23-4) Subhead
24 (24-1, 24-2, 24-3, 24-4) Ink supply way
25 Ink Free Passage Hole
26 Nozzle Train
27-j (j= 1, 2, ..., n) Ink regurgitation nozzle
30 Print Head
31 Parent Substrate
32 4 Color Chip
33 Nozzle Train
34, 34-1, 34-m Ink regurgitation nozzle
35, 35-1, 35-k, 35-q (2 q= three ..., k) Printing chip
36 (36-1, 36-2) Nozzle train
37 Parent Substrate
38 (38-1, 38-2, 38-3, 38-4) Subhead
40 Print Head
41 (41-1, 41-2, 41-3, 41-4) Ink supply way
42a, 42b, 43 Ink free passage hole
45 Print Head
46 Parent Substrate
47 Four Color Printing Chip
48 Ink Regurgitation Nozzle

[Translation done.]